Model Your Watershed

Purpose

To introduce students to their watershed and how it works.

Overview

Beginning students construct a three-dimensional model of a watershed and experiment with water flow. Intermediate and advanced students use topographic maps and Landsat images to construct a three- dimensional model of their watershed and test hypotheses about water flow.

Time

For beginning levels: one class period

For intermediate and advanced levels: two to three class periods

Level

All

Prerequisites

For intermediate and advanced levels: basic understanding of maps and familiarity with topographic maps and Landsat images

For background information on contour maps, refer to Contour Line Basics in the Appendix to this investigation

Key Concepts and Skills

Concepts

A watershed guides all precipitation and run off to a common watercourse or body of water.

The Hydrology Study Site is part of a watershed.

The nature of a watershed is determined by the physical features of the land.

Skills

Modeling a watershed.

Predicting water flow.

Interpreting maps and images to create a physical model of the watershed.

Materials and Tools

For beginning levels:

Plywood sheet approximately 1m x 1m

Rocks of various sizes

Plastic sheet

plant sprayer

For intermediate and advanced levels:

Topographic map of your Hydrology Study Site and surrounding area

Landsat image of your GLOBE Study Site (provided by GLOBE)

Plywood sheet approximately 1m x 1m

Plaster of Paris, clay or similar material

Waterproofing material or a household plastic wrap

Preparation

Gather the materials

Obtain topographical maps (refer to "How to Obtain Maps and Remote Sensed Images" in the Toolkit)

Prerequisites

None

Background

A watershed is a system. It is the catch basin that guides all precipitation and runoff (water, sediment, and dissolved materials) to a common watercourse or body of water. A divide is the ridge between drainage areas. You may have heard of the Continental Divide, the ridge that divides the U.S. and causes all river systems east of it to flow to the Atlantic Ocean and all those west of it to drain to the Pacific Ocean. These large watersheds are made up of smaller ones. In this activity, students will locate the boundaries of their local watershed and create a model of it that will be

useful as they study the fresh water system you depend upon.

Human activities, such as building dams to impound water, diverting water over divides from one watershed to another (transbasin diversion), or changing the topography of the land to build roads and other structures, can alter watersheds. Learning about and modeling a watershed is a way to help people grasp the realities of the water system on which they depend – where the water comes from, where it goes, and what kinds of choices people can make to use and conserve it responsibly.

What To Do and How To Do It

For beginning levels:

1. On the plywood board, place a variety of rocks of different shapes and sizes. Place a plastic sheet over the rocks, push down on the plastic around the rocks to give it shape and to ensure that there are high and low spots.
2. Ask your students what they think will happen when they pour water onto various places of this model.
3. Then, have your students use a plant sprayer to spray water over the surface of the model. Keep on spraying until the water flows. Observe how the water flows and where it collects.
4. Discuss with your students what they observed, paying special attention to how the shape of the model effects the flow of the water.
5. Ask your students what would happen if they move the rocks to different places. Ask them how they might arrange the rocks to have a more rapid, or slower flow of water or to have more or less water collect in a specific location.
6. Have your students rearrange the rocks to test their ideas. Repeat this variation several times.

For intermediate and advanced levels:

1. Ask students:

   What is a watershed?

   Why are watersheds important?
2. Provide students with topographic maps and Landsat images of your area. Help the students to get oriented to what is shown in the topographic map and in the Landsat image and how to correlate the two. Assist the students in using the satellite-derived imagery as a similarly-useful resource. Ask the students to identify their watershed with a name, and find its boundaries. Contour lines and elevation changes on the topographic map are helpful in establishing watershed boundaries. By marking hilltops and ridges, students can create a useful outline of their watershed.

   To begin, students should select an easily identifiable point, such as the mouth of a stream. Working backwards from that point, they should mark other obvious points like peaks and ridges that separate adjacent streams. Ask, "Which way would the water flow from this point?" Have students draw arrows to show drainage patterns. The picture of the watershed will become clearer as more points are identified.
3. Provide students with the materials to build a model of their watershed using one of a number of different media. Plaster of Paris, clay, and/or other materials of your choice will work well. Ask the students to work in small groups to create their model. They should cover the model with household plastic wrap.
4. Once completed, ask the students to spray water on the model and trace the path a drop of water takes across the watershed and into the watercourse.
5. Discuss the relationship between the physical features of the watershed and the location of human activities. Focus especially on the patterns of the flow of water in your watershed.

Further Investigations

1. What larger watershed is your watershed a part of? And which watershed is that larger one a part of? Keep asking yourself this question for larger and larger watersheds. What is the largest watershed of all?
2. Compare recent satellite-derived images with those from earlier time periods. What changes have taken place in the watershed?

Student Assessment

1. Ask students to write an essay about the importance of watersheds.
2. Ask the students to describe how each of the Hydrology protocols is relevant to understanding watersheds and their significance.
3. Have students locate several natural physical features and several human-made features on the topographic map, and satellite images. Locate their corresponding positions on the watershed model.
4. Ask students to describe ways in which the physical features of the watershed could influence future human activities. Let them predict ways physical features of the watershed could influence future human activities.
5. Ask students to describe ways in which human activities change the shape of the watershed, and, consequently, the path along which water will flow.

Acknowledgment

Adapted from "Make A Watershed Model" (Aspen Global Change Institute's Ground Truth Studies Teacher Handbook), with additional information from "Understanding Watersheds" from Tennessee Valley Authority